

CLAIMS:

1. A medical instrument comprising:

a guide wire that is inserted at one end through a vascular portion narrowed by deposits and is extended at the other end out of a patient's body;

a rotating cutter that is rotatably and slidably guided over said guide wire and is driven to cut away the deposits in said narrowed vascular portion;

a hollow drive shaft that is operatively connected to said rotating cutter and through which said guide wire is inserted;

a fixed sheath having inserted therein said drive shaft; and

a controller having a drive assembly for rotating said drive shaft;

wherein said rotating cutter is driven to perform intravascular treatment to establish patency of said narrowed vascular portion or to distend said vascular portion;

characterized in that:

said rotating cutter contains on its surface a plurality of independent microscopic cutting edges formed integrally with a mother material of said cutter.

2. The medical instrument of claim 1, characterized in that said rotating cutter can be compressed axially thereof for plastic deformation in a direction in which to enlarge the diameter of said cutter in the case of further distending said narrowed vascular portion after removal therefrom of deposits by said cutter.

3. A medical instrument comprising:

a guide wire that is inserted at one end through a vascular portion narrowed by deposits and is extended at the other end out of a patient's body;

a rotating cutter that is rotatably and slidably guided over said guide wire and is driven to cut away the deposits in said narrowed vascular portion;

a hollow drive shaft that is operatively connected to said rotating cutter and through which said guide wire is inserted;

a fixed sheath having inserted therein said drive shaft;

a controller having a drive assembly for rotating said drive shaft; and

a secondary treatment rotating cutter whose cutting surface has an outside diameter larger

than the maximum outside diameter of the cutting surface of said rotating cutter (an initial treatment rotating cutter);

characterized in that:

said initial treatment rotating cutter and said secondary treatment rotating cutter contain on their surfaces great numbers of independent microscopic cutting edges formed integrally with mother materials of said cutters; and

in the case of further distending said narrowed vascular portion after cutting treatment of said narrowed vascular portion by said initial treatment rotating cutter, said secondary treatment rotating cutter is coupled to said initial treatment rotating cutter on that portion of said guide wire extending out of the patient's body in such a manner that the cutting edges of both of said rotating cutters are sufficiently small and appropriately spaced apart in a direction in which to remove deposits from said narrowed vascular portion.

4. The medical instrument of claim 1 or 3, characterized in that said microscopic cutting edges are microscopic asperities formed on the peripheral surfaces of said cutters, and the heights, depths, widths and lengths of said asperities are chosen such that chippings of said deposits cut by said cutters are 10 microns or below in size.

5. The medical instrument of claim 4, characterized in that said asperities have elongated grooves configured to extend in the direction of rotation of said cutters, gradually get deeper rearwardly in said direction and terminate at the deepest point, and protrusive cutting edges configured to extend upright from said deepest point of said elongated grooves and jut out of the cutter surface.

6. The medical instrument of claim 1 or 3, characterized in that said microscopic cutting edges are formed on the mother material surface of each of said cutter by laser machining, electric discharge machining, chemical etching, press work, pressure welding, or cutting work.

7. The In the medical instrument of claim 4 or 5, characterized in that cutting surface forming areas of said plurality of microscopic asperities forming said microscopic cutting edges are disposed in overlapping relation with one another.

8. The medical instrument of claim 5, characterized in that said plurality of microscopic asperities forming said microscopic cutting edges are composed of asperities whose cutting surfaces face in a normal direction of rotation of said cutters and asperities whose cutting surfaces face in a direction opposite to said normal direction of rotation.
9. The medical instrument of any one of claims 1 to 3, characterized in that the cutter surface is a mirror-finished surface.
10. The medical instrument of any one of claims 1 to 3, characterized in that said cutter surface is coated with a plated layer.
11. The medical instrument of claim 1 or 2, characterized in that said rotating cutter is adapted to be compressed axially by a jig preplaced coaxially with or in proximity to said drive shaft to undergo plastic deformation in a radial direction in which to enlarge the diameter of said rotating cutter.
12. The medical instrument of claim 3, characterized in that said secondary treatment rotating cutter is adapted to be press-fitted, by a jig preplaced coaxially with or in proximity to the drive shaft, into or onto the initial treatment rotating cutter for engagement therewith.
13. The medical instrument of claim 11 or 12, characterized in that said jig has a one-hand operated, squeeze-type lever mechanism utilizing a force-multiplying mechanism by a lever or cam.
14. The medical instrument of claim 1, characterized in that said controller has a mechanism for pushing said rotating cutter out forwardly from a distal end of said fixed sheath toward the affected area and a mechanism for retracting said rotating cutter, and that these mechanisms are actuated by a squeeze-type operating lever provided with an auto-return mechanism and a position retaining mechanism.
15. The medical instrument of claim 1 or 14, characterized in that said controller is provided with a vibrating mechanism for reciprocating said rotating cutter in a direction along said guide wire.

16. The medical instrument of claim 1, 14, or 15, characterized in that said controller has built therein a drive assembly for rotating said drive shaft, and that said drive assembly has a motor provided with a hollow rotary shaft through which said drive shaft is insertable.

17. The medical instrument of claim 1, 14, 15, or 16, characterized in that said controller is provided with a drive shaft chucking mechanism and a soft-sheath attaching/detaching mechanism.

ABSTRACT

This medical instrument is provided with a rotating cutter 3 that is rotatably and slidably held on a guide wire 1 to remove deposits from a narrowed vascular portion 2. On the surface of the rotating cutter 3 there are integrally formed a number of individually independent cutting edges in appropriately spaced-apart relation.

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